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ation of those causes which are leading to the depreciation of money. Our reasonings have been based on a state of peace. A long and general war would not only diminish the production of the precious metals, but would increase the demand for them. But we believe that the results which we have predicted will come to pass, whenever the causes to which they are attributed shall be operative in full, and that the views of M. Chevalier, which we have endeavored thus to unfold, will be justified by future history.

- ART. IV.—1. *Farm Drainage. The Principles, Processes, and Effects of draining Land with Stones, Wood, Ploughs, and open Ditches, and especially with Tiles; including Tables of Rain-Fall, Evaporation, Filtration, Excavation, Capacity of Pipes, Cost and Number to the Acre of Tiles, &c., &c., and more than One Hundred Illustrations.* By HENRY F. FRENCH. New York: A. O. Moore & Co. 1859. pp. 384.
2. *Elementary Treatise on the Drainage of Districts and Lands.* By G. D. DEMPSEY, C. E., with Illustrations. London: John Weale.
3. *Practical Landscape Gardening, with Reference to the Improvement of Rural Residences, giving the General Principles of the Art; with full Directions for planting Shade-Trees, Shrubbery, and Flowers, and laying out Grounds.* By G. M. KERN. Second edition. Cincinnati: Moore, Wilstach, Keys, & Co. 1855.

It was the King of Brobdignag who avowed the opinion, “that whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before, would deserve better of mankind and do more essential service to his country than the whole race of politicians put together.” Whatever may be said of politicians, there can be no doubt that the scientific farmer is a public benefactor. Government-tinkers and place-hunters may be, like Cardinal Wolsey, men of “unbounded stomach”; but, aside from the “home market” which they furnish in their own persons,

they are of very small account in this "working-day world." They are mere consumers. The agriculturist, on the other hand, is the chief, if not the only, food-producer, or, more properly, food-manufacturer for the nation. He it is who turns Peruvian guano and superphosphate of lime into wheat, bones from the Pampas into esculent roots, Russian oil-cake and Syrian locust-pods into beef and mutton. But to do all this he must be intelligent, — acquainted with something more than the manipulations of the spade and the wheelbarrow, with something higher than the vulgar traditions of an ignorant ancestry. It is only under the hand of such men as Robert Bakewell, Jonas Webb, and Josiah Parkes, that long-legged, slab-sided, ill-bred oxen are metamorphosed into small-boned, quick-fattening Devons and elephantine Durhams; that lean, hurdle-backed Norfolk rams become beautiful "firkin-bodied" South Downs; that drifting sand-plains are converted into corn-fields, and shaking fens, from which benighted travellers were once warned by beacon-lights, are transformed into English gardens and apple-orchards.

Every book, therefore, which sheds new light upon the principles and processes of agriculture in any of its departments, we welcome as a contribution to the public welfare. Such is the work whose title we have placed first at the head of this article. Elaborate in its explanation of methods, and lucid in its philosophical statements, it leaves little to be said by others on altogether the most important branch of American husbandry. It is tastefully printed and illustrated; and, if read at every farmer's fireside morning and evening "with judicious care," it would soon renovate the face of the country, clothing the exhausted fields at the East with fresh verdure, and turning the ocean-like prairies of the West, now to a large extent too wet for tillage or for health, into the very garden of the world. The author is one of those versatile, open-eyed men, whose constant and careful observation of minute and disconnected facts is happily accompanied by a rare power of analysis and generalization. He presents a pleasant combination of scholarly culture and practical energy, and is equally at home at the forum and in the field, discharging with singular tact the twofold function of an accomplished jurist and a skilful tiller

of the soil. He seems to receive from frequent contact with the earth fresh vigor for wrestling with hard questions of law. For many years associate editor of the *New England Farmer*, and special contributor to other similar journals, he has devoted the leisure wrung from a laborious profession to the study and practice of agriculture. His articles and addresses are not the mere speculations of a white-handed theorist, but they all have the flavor of fresh-ploughed fields and new-mown hay. As a racy and instructive writer upon the various topics connected with the garden, the orchard, and the farm, he has no superior and few equals in this country. He has the faculty of making all his resources, of whatever nature, contribute to the illustration of the particular subject in hand, no matter what that subject may be. The necessity of "gratings at the outlet of drains," in order to keep out all sorts of vermin, is not a very promising topic for pleasant rhetoric, and yet the pages occupied by him in its discussion sparkle with flashes from Virgil and Shakespeare, Coleridge and Matthew Prior.

"There are," he says, "many species of vermin, both creeping things and 'slimy things that crawl with legs,' which seem to imagine that drains are constructed for their especial accommodation. In dry times it is a favorite amusement of moles and mice and snakes, to explore the devious passages thus fitted up for them; and entering at the capacious, open front-door, they never suspect that the spacious corridors lead to no apartments, that their accommodations, as they progress, grow 'fine by degrees and beautifully less,' and that these are houses with no back-doors, or even convenient places for turning about for a retreat. Unlike the road to Hades, the descent to which is easy, here the ascent is inviting; though, alike in both cases, '*Revocare gradum, hoc opus, hic labor est.*' They persevere upward and onward, till they come, in more senses than one, to an 'untimely end.' Perhaps, stuck fast in a small pipe tile, they die a nightmare death; or perhaps, overtaken by a shower, of the effect of which, in their ignorance of the scientific principles of drainage, they had no conception, they are drowned before they have time for deliverance from the strait in which they find themselves, and so are left, as the poet strikingly expresses it, 'to lie in cold *obstruction*, and to rot.' In cold weather, water from the drains is warmer than the open ditch, and the poor frogs, reluctant to submit to the law of nature, which requires them to seek refuge in mud and oblivious sleep in winter, gather round the outfalls, as they do about springs, to

bask in the warmth of the running water. If the flow is small, they leap up into the pipe, and follow its course upward. In summer, the drains furnish for them a cool and shady retreat from the mid-day sun, and they may be seen in single file by scores, at the approach of an intruding footstep, scrambling up the pipe. Dying in this way affects these creatures as ‘sighing and grief’ did Falstaff, — it ‘blows them up like a bladder.’ ”

In the summer of 1857, Judge French visited Europe for the purpose of acquainting himself with the superior modes of husbandry in the Old World. The few months spent among the intelligent farmers of England confirmed him in his previous impression, that the first duty in American agriculture is systematic and thorough drainage; and the value of the volume before us, treating of “the principles, processes, and effects of draining land,” is not a little enhanced by the writer’s careful attention to the working, in the mother country, of the various systems of Elkington, Smith of Deanston, Josiah Parkes, and Lord Wharnccliffe.

The sixty million acres of swamp lands, given away as worthless by our general government to the new States in which they lie, constitute but a very small portion of the territory in these United States, which might, by judicious drainage, be transformed from unsightly, pestilential “bog-holes” into waving grass and grain fields of exhaustless fertility. If Great Britain, a country of less area than our youngest State, is justified in loaning \$40,000,000 to companies engaged in the drainage and improvement of her highlands, certainly the subject so ably discussed by our author cannot be unworthy of the earnest consideration of the American public. It is to be remembered that the agricultural districts of this country are lower and flatter than those of England, and that they receive *double the amount of rain-fall* per annum. We have no doubt that the value of the prairie lands in Illinois, Indiana, Iowa, and Missouri might be at least trebled by a proper distribution of drain-tiles, four feet under ground. The face of the country might in this way be entirely changed. Corn, instead of being dropped into sub-aqueous drills from a raft, in June, with poor prospect of a harvest, might be planted on dry ground, early in May, with an assurance of reaping a

hundred-fold. Wheat, no longer frozen out of the clayey soil every winter, might yield, not twelve, but, like John Hudson's on his Castle Acre farm, "forty-eight bushels to the acre." The farmers themselves, now shaking with intermittent chills amidst the noxious miasmata that rest like a pall upon coarse sedge and miry pools, might riot in fragrant clover and luxuriant health.

The present great need in this country is, first, a more thorough investigation of the principles of agriculture by scientific men, and, secondly, a more ready application of these principles to the processes of agriculture by workingmen. A better understanding between these two classes would be an advantage to both. It is a pleasant indication of progress in the right direction, that professional men are beginning to take a more active interest in the material affairs of the field and the workshop; that the toil-hardened hand and weather-stained face are now regarded by none, except patent-leather, tape-selling cockneys, as marks of dishonor, but rather as the heraldic emblems, the armorial insignia of Nature's noblemen. Emerson is right when he says: "The first farmer was the first man, and all nobility rests on the possession and use of land." If, as Hebrew scholars tell us, Adam, the parent of all living men, means, etymologically speaking, "dark loam," then are the bonds of relationship between us and this teeming earth fixed in nature, and strong as the ties of blood. We are fed literally from the same maternal bosom, and the theory of a human brotherhood is something more than a dream of philanthropy. It was the boast of the Athenians that they were *αὐτόχθονες*, — children of the soil; that, in the olden time, they, like their olive-trees, sprang out of the ground. Attica, with its vine-clad hills and fertile valleys, was to them, therefore, not merely a territorial possession, but it was, as Thucydides expresses it, "a father and mother land." Every rood of it was consecrated in their affections; and the foreign foe who ventured within its borders was sternly encountered, as an invader of the privacy and sanctity of home; while the citizen who should raise his hand against it was treated, not as a traitor only, but as a parricide. The old Roman, though condemning the subtilties of the poetic Greek, yet, like him,

recognized his relationship to the soil. It is a noteworthy fact, that the words *ground* and *man* have, in the Latin language, a common root.

But, leaving to scholars the niceties of philological discussion, one thing we may affirm as certain: A nation is strong only when, like the fabled Libyan giant, it rests its feet upon the solid earth. Land is the basis of our power; the everlasting hills are the pillars of our imperial sovereignty. Men, in successive generations, may give themselves up in mad frenzy to slaughter and extermination; dynasties may follow dynasties in lengthening cycles of misrule and oppression; the reflux wave of barbarism may dash against the broken arches of a former civilization; palaces, temples, capitol, all the trophies of art, may pass away in the ages like the ephemera of a summer morning; but Nature is eternal, and the husbandman is her minister, and should be her interpreter. In dealing with her mysteries he is dealing with the principles and laws which regulate the growth and determine the destiny of a people. The stewardship of our nationality is vested in the men who till the soil; for it depends on them whether our fields shall be yellow with corn, and a wide-spread commerce relieve our bursting granaries, or whether we shall return to the want and savagism of a past age, and worship again the "sacred oak," — *sacred* because it feeds us with acorns. It becomes a question, therefore, of the highest moment, how these men shall be awakened to a consciousness of their position, and furnished thoroughly for the discharge of their weighty responsibilities. How shall agricultural and mechanical labor, tasking as it does the energies of three fourths of the working male population of these United States, be elevated to its highest dignity and efficiency? The answer is as obvious as it is emphatic: By making the man of action a man of thought. Muscle must not be divorced from mind. It was said of Lord Bacon, that he never used one of the hundred hands of Briareus until he had opened all of the hundred eyes of Argus. There never was a great act, whose pedigree might not be traced back to some great thought as its ancestor.

We propose, in the further consideration of Judge French's book, to expatiate a little upon the subject of Educated Labor,

incidentally treated by him ; and if our readers do not discover a tile-drain running through our article, it will be either because our tiles are laid so deep as to be invisible, or because our discussion, as we proceed, may seem to us so dry as not to need draining.

There are counties in England, in which, not long since, according to governmental statistics, only one person in ten could read ; and at a little earlier period, if we may believe pleasant Arthur Young, "not one farmer in five thousand did read anything at all." In these same districts the old Roman plough and harrow still belabored the patient soil, and the cattle were cured or killed by enchantment. The peasants wore charms for the ague ; nailed horseshoes on the threshold to keep out the witches ; carried around in their pockets pieces of a coffin to ward off the cramp ; and tied red strings around the tails of their new-milch cows to prevent the fairies from stealing the butter. In Italy, as we are told in some recent reminiscences of travel, the farmer breaks up his land, not with a double-eagle plough, but with the root of a tree, attached by a grape-vine to his two cows. This remarkable style of tillage, however, is altogether outdone in Egypt, where Stephens assures us that the insulted ground is vexed by a grotesque thing, ycleped a plough, constructed in some pre-Adamic era, and actually drawn in the furrow by an old woman and a jackass harnessed together. We shrewdly suspect that the modern traveller had been reading Pliny, who made the same extraordinary statement some eighteen hundred years ago.

There are among ourselves not a few whose brawny strength is turned to weakness by their ignorance, and whose stalwart manliness is dwarfed by the hereditary taint of a thousand shrivelling superstitions. They tremble and turn pale at the breaking of a looking-glass, or at the upsetting of a salt-cellar, or at the ticking of a little harmless insect which they have named the death-watch. They would no sooner engage in any important enterprise on Friday, than an old Roman general would go into battle when the sacred chickens refused to eat their dough with the proper relish. They never look at the new moon "over the left" without an indefinable apprehension

of evil ; nor pass in the evening a retired churchyard without encountering some unhappy ghost, or haunting devil. They will not wean their calves when the sign is in the stomach, for fear the poor animals may pine away over their meal and clover ; and the pig whose tail unluckily curls to the left is, they are sure, scarcely worth the raising. They could not be persuaded to plant their potatoes on the increase of the moon, lest they all run to tops ; nor to kill their swine on the decrease of the moon, lest the pork boil away in the pot. If an ill-fed or sick ox have nothing in his second stomach to be pumped up for rumination, they are certain he has “lost his cud,” and will die, of course, unless they can manufacture a new one for him. If an unfortunate cow, from exposure to storm or cold, should, in the first flow of her milk, have a swollen bag, they thrust a butcher-knife through her dewlap, and insert a garget-root, or else saw off one of her horns.

It is a matter of congratulation that the common school and the agricultural journal are fast driving this whole brood of party-colored superstitions and follies, like spectres of night, to the mountain-caverns and forests on the outer rim of civilization. Let scientific men do their duty to the community, and the time is not far distant when no place shall be found among us for the “sole of their unblest feet.” Every profound thought lifts a shadow from the earth. Every good book, whether it treat of “Farm Drainage” or “Celestial Mechanics,” helps forward the millennium.

The advantages of intellectual culture are as obvious in those pursuits involving manual labor, as in the learned professions, so called. A good education is of some consequence to the lawyer and the physician ; it is of not less consequence to the mechanic and the farmer. We have known professional men who could make a little learning go a great way with the wondering multitude ; but such poor tricks cannot be played off upon the hidden forces of nature. It is the finger of Intelligence alone which can touch the secret springs that set the mountain streams to the music of machinery, and clothe the naked fields with waving grain. It is a maxim in New England factories, where a fluctuating and often hostile tariff has taught a wise economy, that they cannot afford to hire cheap,

ignorant labor. Not many years ago a factory in Lowell imported a large number of workmen from England. But it turned out that these persons, though paid but half the wages of the better-educated operatives at home, were nevertheless an expensive luxury to their employers. They could not earn their living, and, in a few weeks, they were all, with three or four exceptions, dismissed. A partner in one of the most respectable mercantile houses in Boston, having the principal direction of extensive cotton-mills, stated, a few years ago, in reply to the interrogatories of a Congressional Committee, that, of the twelve hundred operatives annually employed by him, forty-five only were unable to write their names; and that the difference between the average wages of these forty-five and of the remaining eleven hundred and fifty-five was just twenty-seven per cent in favor of the latter. There were also in the same mills a hundred and fifty girls, who had been engaged in teaching school. The wages of these school-mistresses was seventeen and three fourths per cent above the general average, and more than forty per cent above the wages of those who were obliged to make their mark. It is safe to affirm, that there is not a cotton-mill in the country, with operatives, whether native or foreign, too ignorant to read and write, which could be made to yield a profit in the best times. The fabrics would be inferior in quality and in quantity; the machinery would be misused and prematurely worn out; and the stockholders would be soon brought to a realizing sense of the difference between dividends and assessments.

We are not of those who entertain a prejudice against foreigners as such. We care not what may be a person's origin, name, or complexion.

“Tros, Tyriusque mihi nullo discrimine agetur”;—

a verse unconsciously, though happily, rendered by Robert Burns in his democratic song:—

“A man 's a man for a' that.”

But still, though revering as we do the splendid names in Irish history, we cannot conceal from ourselves the obvious fact, that the introduction of uneducated Irish “help” in the

field is working the same mischief to our sons, which its introduction in the kitchen has already wrought to our daughters. It is making labor dishonorable by associating it with ignorance, and is therefore driving our young men away from the old homesteads,—some into mercantile pursuits, some into the over-crowded professions, some into the wild hazards of stock-speculation, or into the still wilder hazards of gold-digging at some far-off Pike's Peak or Fraser River. In this way our farms in the older States, instead of being divided and subdivided, as they ought to be, are growing larger and more unmanageable. The tendency of the times is unquestionably towards immense estates, like those in England, each with a manorial mansion in the centre, and a dependent tenantry crouching in its shadow. We need not say that this is not “a consummation devoutly to be wished.” If there is anything which we as patriots should deprecate and struggle against with sternest resolution, it is the gradual division of our people into the two classes of land-holders and tenants,—an educated nobility and an ignorant peasantry,—the wealthy few and the poverty-stricken, grovelling many. The immigration into this country of intelligent foreigners, who, like very many of the Germans and a very few of the Irish, appreciate and admire the freedom of our republican government as intensely as they hate the tyrannies, civil or ecclesiastical, of the Old World, is a matter, not of anxious solicitude, but of national felicitation. But the extraordinary influx of men, bringing with them little wealth and less intelligence, trained to unthinking, servile toil, and accustomed to look with helpless awe upon the glittering pageantry of monarchical institutions, is threatening, as its legitimate result, the gradual transformation of American society. The change, of course, is noiseless in its progress, but, unless arrested, it will be palpable enough in its effects. The laws of social chemistry are as fixed and inexorable as those which regulate the combinations of the laboratory. Athens, though her natural position and unequalled harbor, as well as the character of her native-born citizens, seemed to indicate that she was preordained to be the mistress of the world, yet was not able to withstand the deteriorating influence of vast hordes of unlettered “barbarians,” pouring continu-

ously into her streets from petty despotisms or conquered provinces, supplying the Bema and the Academy with the gross amusements and empty shows of the amphitheatre, and degrading a cheerful industry to the reluctant toil of enslaved Helots. If we allow labor on the soil, north or south, to be surrounded with menial associations, we should not be surprised that the Anglo-Saxon, rather than stoop to it, chooses to live by his wits, or to die like a fool in some ill-omened expedition of piratical fillibusters.

We can remember, young as we are, when the farmer's daughter deemed it no disgrace to her to "work out" as "help" for any respectable man, whose son, perchance, in process of time, deemed it no disgrace to him to take her as his wedded wife, if he could get her. But now he would be a bold man who should venture within any farm-house in New England, and attempt to secure, at any price, the services, as cook or chamber-maid, of either one of the half-dozen young ladies working worsted at the front windows, or reading the last orange-tinted novel on the tear-besprinkled sofa. In all probability Bridget would be called from the kitchen, and the rash and unromantic intruder unceremoniously and ignominiously swept out like a muddy boot-track, or mopped up like an unlucky slop. These things ought not to be. Far be it from us to say aught in disparagement of the highest personal accomplishments and the amplest literary leisure. But these, so far from being inconsistent with the industrial pursuits of life, are its most appropriate embellishments. The kitchen and the field alike should be, in fact and in public estimation, laboratories of science, in which the speculations of theorists are daily tested and authoritatively pronounced either wise or worthless, as the result may prove them to be. Labor, to be respected, must be respectable; to be lucrative, it must be intelligent.

Cotton cloth was first made in Hindostan, centuries ago, and its manufacture is still continued there in all its original simplicity. But to-day one Yankee in Lowell or Manchester can spin with the mule as much cotton as three thousand Hindoos can spin with any machinery of their contrivance. In the sleepy sunshine of that Southern clime, the red brawn of the people lacks the electrifying influence of genius. The inert

organism, called a body, is interpenetrated with barely thought enough to "save the expense of salt." The truth is, in every department of human labor, he succeeds best who brings to his work, not the greatest physical strength, but the keenest intellect.

The agriculturist, dealing not merely with inanimate matter, but with the vital forces of nature, needs, most of all things and most of all men, intellectual culture in the broadest and deepest significance of the term. We shall have, however, space only to indicate, in a general way, two departments of knowledge, to which every farmer should give especial attention; — first, he should know how to make his fields in the highest degree productive; and, secondly, how to render his home beautiful. In other words, he should be familiar with the conditions of vegetable growth, and with the principles of good taste in their application to rural embellishments. Let us briefly consider each of these desiderata.

All vegetables, whether grain or grass, trees or turnips, corn or cotton, require, as absolutely indispensable to their growth and maturity, at least six things; namely, heat, air, moisture, food, light, and protection from destructive insects. Of these, we shall see as we proceed, that the first and most important four can be made available to a majority of the farmers in this country only by subjecting their lands to a system of thorough drainage.

No plant can germinate without a certain degree of *heat*. Each plant, however, has its own peculiar range of temperature. Wheat will not germinate when the soil is below 45° Fahrenheit, or above 95°. Corn requires 10° more heat than wheat. Should it be planted, therefore, when the soil does not indicate 55° at least, its starchy portions, if the weather continue wet and cold for a week or two, will be decomposed and diffused, wholly or in part, through the soil, so that when the warmth becomes sufficient to quicken the germ into activity, the plumule, failing to find the proper nourishment at its root, does not appear at all, or comes up a puny starveling, and, after living a few weeks "at a poor dying rate," expires, like the wretched Cardinal, and "makes no sign." This principle is universal in its application to the germinating processes

of the vegetable kingdom. The man, therefore, who puts his seed into the ground without any reference to its temperature, is liable both to lose his time and to "beg in harvest."

But heat is quite as important to the growth of the plant as to its germination. It is a very remarkable mathematical law, recently ascertained in M. Quetelet's researches upon the climate of Belgium, that *the increase of growth is as the square of the increase of the temperature of the soil*. If a corn-plant, when the earth in which it grows is 20° above the freezing point, adds to its weight three grains in one day, it will in the same period add twelve grains, or four times as much, when the thermometer is twice as high, or at 40° above freezing. It is obviously, then, of some consequence, in our higher latitudes, to supply by our skill any natural deficiency of heat in the soil. There are three methods of doing this, — two partial, and one general. We may, in accordance with a well-known political principle, select for our premium crop a piece of land, which, like a candidate for some high office in the nation, has a southern exposure, and which will, therefore, receive a greater number of solar rays on a given area than a northern slope or a horizontal level; we may blacken the surface of our soil with charcoal-dust and meadow-muck, and thus increase indefinitely its power of absorbing heat; or we may gain at least a fortnight every spring, and secure a warmer soil through the season, (maturing our potatoes and corn before the rot and frost strike them,) by thorough under-draining, drawing off the superabundant waters, which, by their evaporation, chill the ground, until its "sensible warm motion becomes a kneaded clod," and the root-fibres in their paralysis are unable to supply the plant with its currents of life. It has been found by accurate experiment, that the vaporization of water requires one thousand times as much heat as would be sufficient to raise its temperature a single degree. We should not be surprised, therefore, that the evaporation of one pound of water from one hundred pounds of saturated earth causes a loss of ten degrees of heat; or, as Judge French enunciates the principle, that "the evaporation of every gallon of water requires as much heat as would raise five and a half gallons from the freezing to the boiling point." We say nothing of

the familiar fact, that heat cannot be propagated downward in liquids. Every one knows that a cord of the best hickory would not be sufficient to make one small tea-kettle boil, if the wood should be burned above the kettle rather than below it. The surface of a "water-logged bog" may be burned and "shrivelled like a parched scroll," while the saturated sub-soil is as cold as in mid-winter. The warm spring rains run off from the surface of a soil saturated with snow-water, but penetrate a well-drained soil, imparting to it a portion of their own warmth, and enriching it with various elements of fertility. This point, in connection with the laws of heat-propagation in fluids, is thoroughly discussed and happily illustrated by our author in his fifteenth chapter, to which we commend our philosophic readers.

But stagnant surface water, in addition to its chilling effects, hardens and packs the soil so closely as to render it impervious to the *air*, thus preventing the second condition of vegetable growth. If the air be exhausted from a bell-glass, in which any common house-plant has been placed, the plant will die in a few minutes beyond the reach of recovery. If the air be shut out from the roots of the thriftiest fruit-tree in our garden by overspreading the ground for some ten feet from its trunk with a puddling of impermeable clay, the tree will sicken and eventually die for want of breath. On the same principle, cattle, standing in considerable numbers during the hot season under some favorite shade-tree in the pasture, not unfrequently cause its death. Its roots are suffocated under the hard earthen crust which covers them.

The fertility of a field is wonderfully increased by the oxidation or decay of the organic matter existing in the soil. But oxygen is indispensable to oxidation, and the process, therefore, can be carried on only by the presence and frequent renewal of the air. Our success in preserving fruits in glass jars or tin cans, is measured by our success in excluding the oxygen of the air. Without such exclusion, our tomatoes and berries undergo the very process to which we should like to subject them in the ground, but which does not heighten their excellence for the table,—they oxidate, or, in familiar language, they rot. We see, in the light of these and kindred

facts, the philosophy of thorough tillage. Draining, by relieving the soil of its excessive moisture, secures its proper aeration, and thus, while facilitating important putrefactive processes, which are checked by the presence of cold water, it furnishes also to the plant-roots the carbonic acid and ammonia always indispensable in "intensive culture." The destruction of weeds among our corn and potatoes is not the highest use of the hoe and cultivator,—their chief function is to render the soil porous and permeable to the air.

The third condition of vegetable growth is a sufficiency of *moisture*. In many countries this can be effected only by artificial irrigation. In Scripture phrase, "the rivers of water are turned" into the fields, or the same thing is accomplished by means of "pots," suspended from a sort of yoke across the shoulders of slaves. This last method is referred to by the writer of the eighty-first Psalm, and a picture of it was made the significant emblem of Aquarius, the eleventh sign of the zodiac. The definition of Oriental agriculture is "valuable machinery for raising water." This definition will answer for New England to-day as well as for Egypt three thousand years ago. But with us the only machinery necessary is, first, an Irish spade, with an Irishman thrown in as a "dative of accompaniment," and, secondly, a Michigan plough, with a good team of horses or oxen at one end, and a skilful ploughman at the other. Let there be a deep and thorough pulverization of the soil and sub-soil, and, except in extraordinary cases, capillary attraction will raise an adequate amount of moisture. Besides this, when the rain fails to come in its season, the warm air, saturated with vapor, will permeate the well-tilled, porous soil, and, coming in contact with the cooler plant-roots, will deposit with them its dewy treasures, just as it does with the cabbage-leaf in the garden, or with the outer surface of a pitcher of iced water on a hot day, or with a frosty axe when held near the fire. The principle is perfectly simple. The capacity of air for moisture is diminished by cooling it; and whenever, therefore, in a state of saturation, it meets a colder body, whether above ground or below, the water is squeezed out of it just as we squeeze with the hand a juicy lemon or a wet sponge. The amount of dew deposited in the soil or on

it has been estimated by Dr. Dalton to be equal, in England, to five inches' depth of water in a year. In this country, where the nights are clearer, there must be more, — as much at least as would be equivalent to “one quarter of our rain-fall during the six summer months.”

Under-drains are not merely useful in carrying off the floods in a rainy season ; they also greatly mitigate the severity of our scorching droughts. They do this in three ways. First, a deep-drained, thoroughly pulverized soil is in just the right condition, as we have seen, to absorb moisture from the air ; secondly, it has a greater power both of drawing up water from the lower strata, through its countless capillary tubules, and of holding it when thus drawn up ; and, thirdly, it invites the plants to extend their researches to unexplored depths. Wheat, which, like Mr. Denton's, has roots nine feet long ; parsnips, which, like Sheriff Mechi's, run down “thirteen feet and six inches” ; and lucern, which, like Mr. Cobbett's, “sends its roots thirty feet into a dry bottom,” — certainly need have no apprehensions, though “a hot and copper sky” distil no rain upon the earth for a few months.

The fourth and most important condition of vegetable growth is an abundant supply of suitable *food*. It is a fundamental proposition in agriculture, that all plants live by eating, — grow by what they feed on. From the delicate moss, which clings to the hard rock, up to the “high-haired oak,” of which Homer sings, every green thing, if it does not, like some human vegetables, live to eat, must eat to live.

The whole outward fabric of nature, whether vegetable, animal, or mineral, is built up of some sixty elements, of which not more than one fourth enter into the composition of our ordinary edible plants. From these dozen or fifteen articles of diet, each particular plant, whether rose or ruta-baga, chooses those adapted to its constitution, as carefully as an epicure at a *table d'hôte* makes his selection from a bill of fare. Unlike the epicure, however, the plant seeks no variety, but is satisfied with its one course of soup, morning, noon, and night, from infancy to old age, only varying the relative proportion of the ingredients in different periods of its growth. Its food, aside from certain invisible gases absorbed by its leaves, is

always liquid, and is sucked up by its rootlets or spongioles, not exactly as a "fast" youth sucks mint-juleps through a straw, but by a law of *osmotic diffusion*, classically defined *endosmose* and *exosmose*.

What we call manure is known in the Ionic dialect of science as food for growing crops. There are two general divisions of manure, organic and inorganic ;— the former consisting of decayed matter, or *humus*, which had once been organized into some form of vegetable or animal life ; and the latter being the dust or detritus worn off from rocks, partly by friction, but chiefly by frost, heat, and the play of chemical affinities. Of these elements the most important are four gases, oxygen, hydrogen, nitrogen, and chlorine ; five metals, potassium, sodium, calcium, magnesium, and aluminum ; and four metalloids, carbon, silicon, phosphorus, and sulphur. These are seldom found simple, but in various combinations among themselves, and with other substances, such as iron and manganese. Water is a union of oxygen and hydrogen ; air, of oxygen and nitrogen ; ammonia, of hydrogen and nitrogen ; carbonic acid, of oxygen and carbon ; sulphate of lime (gypsum), of oxygen, sulphur, and calcium ; carbonate of potassa (potash), of oxygen, carbon, and potassium ; and so of all the rest. These unions of acids and bases constitute the various neutral salts, which Nature, like an enthusiastic chemist, is constantly forming, decomposing, and re-forming, for her own amusement, in her two laboratories, the soil and the plant. The combinations of greatest interest to the agriculturist are potassa, lime, soda, magnesia, alumina, silica, carbonic, sulphuric, phosphoric, and hydrochloric acids, and the oxides of iron. Of these, potash is supplied in great abundance by recent ashes and by the disintegration of granite, about fifteen per cent of whose felspar, when *orthose*, is potash. Soda, magnesia, and chlorine abound in common salt, and exist also, together with lime, the silicates, and sesquioxide of iron, in ashes, leached or unleached. Alumina is the basis of all the clays, and though no trace of it has yet been detected in any plant, its mechanical value, as a retainer of moisture and of useful gases in the soil, can hardly be over-estimated. Silica is extracted from rock crystal and the quartz of our

granite, by the action of the weather and the more effective action of the plough and harrow. Sulphuric acid is furnished in gypsum and in all the sulphates. Phosphoric acid constitutes nearly one fourth of the bones of Mammalia and of birds, and is found largely in guano. Carbonic acid, as well as ammonia, is the universal product of the putrefactive processes of vegetables and animals. It is the result, too, of combustion, both of burning wood and of burning food. Whether discharged from the chimney-top or from breathing lungs, it is brought back from the atmosphere down to the earth in every fall of rain and snow. To intelligent farmers, the application of facts like the foregoing is obvious. If the ashes of potatoes consist chiefly, as in fact they do, of potash, sulphuric acid, phosphoric acid, lime, magnesia, silex, and iron, it is perfectly plain that these ingredients must be in the soil, or there will be no potatoes. A brick house cannot be made without bricks. It was an axiom with the old philosophers, as enunciated by Lucretius, "*De nihilo nihil*," — that is, we cannot create something out of nothing, whether that something be a potato or a planet.

There is one noteworthy peculiarity in plants, as distinguished from animals. They require absolutely and unconditionally certain kinds of food, which cannot be replaced by any substitute. The amount of any one specific kind may be extremely small, — discernible in its infinitesimal minuteness only to the eye of the chemist; but unless that is supplied, the functions of life and growth will not be carried on. The kernel of wheat cannot be developed without phosphoric acid and ammonia; the stalk, in common with that of all kinds of grains, must have silex, or the rapidly ascending sap will burst the feeble tissues, and the promising harvest, in popular phrase, will be "struck with the rust." An eminent lawyer of Maryland, by a liberal application of phosphate of lime to his worn-out lands, under the advice of a book-farmer, increased his yield of wheat from one peck to twenty-nine bushels per acre. Clover, peas, and beans, as well as tobacco, that

"Indian weed,
Which from the Devil did proceed,"

are all fond of lime, and should, therefore, be fed with gypsum. Raspberries and blackberries have a hungry appetency for potash, and so they cling to crumbling stone walls, and spring up, as by enchantment, on burnt ground. But we need not pursue this topic further. If our young farmers would spend their rainy days and winter evenings in the careful reading and study of books on chemistry, instead of hunting in the mud for the patten-tracks of their great-grandfathers, the knowledge easily acquired, in spite of the hard names, would shed upon their daily work a light more cheerful than that of the sun. They might not become Liebig's or Boussingaults, but they could learn enough to protect themselves from the imposition of scientific mountebanks, and to conduct properly to their legitimate issue experiments on their farms, whose results might be of incalculable advantage to the agricultural community. Bacon lost his life in stuffing a hen with snow, in order to ascertain the effect of cold in the preservation of meat; but upon the foundation of his experimental philosophy two institutions were established, which still continue perennial fountains of knowledge,—the Royal Society of London, and the Academy of Sciences at Paris.

The relation of "Farm Drainage" to this topic of plant-food is patent enough when we consider that, in much the larger portion of our arable territory, draining is an indispensable prerequisite to an increased depth of soil; and the deeper the soil, the richer and more extensive the feeding-ground for the plant-roots. A horse fastened to a post in a clover-field, by a rope a hundred feet long, would be more likely to "wax fat and kick," than if tied to the same post by a rope of half that length. Just so, a hill of corn, whose roots can expatiate in a soil four feet deep, ranging at will among "fat things full of marrow," will, in the autumn, bristle on all sides with full-grown ears; while one whose roots are compelled, by "hard pan" or stagnant water, to spread like spiders' legs over the exhausted surface of the ground, will wear a "lean and hungry look" through the summer, and finally will yield to the granary a puny handful of cobs.

Another condition of vegetable growth is *light*. All plants are, in the strict Greek sense of the word, *heliotropes*; they

turn to the sun. The potato-vine, in the cellar, crawls like a serpent towards a crevice in the wall, through which the light streams in once a day, and the blossoming tree inclines its thousand tinted corols to catch the first ray from the sun in his rising. One of the most important functions in the vegetable economy—the absorption of carbonic acid from the atmosphere, and the exhalation of its oxygen, by means of the leaves—is performed only in the daylight. Dumas, the French chemist, says, that plants absorb carbonic acid with so much avidity, that the air blown with a bellows over a branch of fresh foliage, placed in a glass globe, loses, in its rapid passage over the leaves, every particle of its carbonic acid, provided the sun shine on the process. In darkness this action does not take place. Flowering plants in our houses are, of course, healthful in the day-time, but do no good in the night. If a jar be filled, half with chlorine and half with oxygen, there is no union so long as they are kept in a dark place; but when exposed to the direct rays of the sun, they instantaneously unite, with a violent detonation, and a probable shivering of the glass to atoms. It is the solar ray alone which decomposes the watery sap in the upper surface of the leaf. Without its chemical power, there would be no carbon to form, by various affinities, the starch, sugar, gum, and woody fibre necessary to the development of the plant. The intelligent farmer, therefore, whether cultivating corn-fields or apple-orchards, will do well to remember that he always “stands in his own light,” when, from any carelessness of arrangement or any unwise economy of space, he fails to secure to his growing crops an abundance of the blessed sunshine. Never inappropriate for him is Milton’s august invocation:—

“Hail, holy Light! offspring of Heaven first-born,
Bright effluence of bright essence increate!”

The sixth and last condition of success in vegetable cultivation, to which, though, like the preceding condition, it has no relation to drainage, allusion should be made in this discussion, is the *protection* of our growing crops from *destructive insects*. Every farmer should know, that in the insect world he has his friends as well as his foes; he should know, too,

how to discriminate between them. Without stopping to speak of the familiar fact, that insects, besides their chrysalid or intermediate state, have two forms of active existence, the larva and the winged form, we will specify briefly two or three classes whose services deserve our kindly regard.

The Carabidæ are ugly-looking, dark-colored, fast-running bugs, of different sizes, having wings concealed under stiff, horny cases, and living under loose stones or pieces of board. They are hatched from eggs deposited in the ground, and both in the larva and in the perfect state they are fierce destroyers of cut-worms and of the slate-colored grubs, which sometimes lay waste our gardens.

The Cicindaladæ, or tiger-beetles, which we see, in sunny summer days, running and flying before us in the trodden paths, embellished with handsome spotted and striped wing-cases, are as carnivorous as the Fejee-Islanders. Not an insect, which once comes within the reach of their mandibles, ever has another opportunity to eat leaf of tree or stalk of corn.

The mason-wasps are pitiless insect-murderers. They lay their eggs at the bottom of little clay cells, which they plaster to our attic ceilings, or fashion in the ground, and then fill them with immense quantities of spiders, caterpillars, or canker-worms, that their young, when hatched, may eat their way up through successive layers of fresh meat, until their wings are ready for the upper air. Levi W. Leonard, D. D., who contributed to the late Dr. Harris, his classmate, not a few of the most important facts in his published works, and who is undoubtedly at this time the best entomologist in his State, recently told us, that he once found in the six or eight cells belonging to one of these wasps, seventy-nine spiders, not really killed, but so stung and benumbed as to lie still and wait to be eaten, with the glorious indifference of stoics or martyrs.

The Aphides, or plant-lice, which exhaust the juices from the tender growth of apple-trees and the young leaves of peach-trees, are swallowed by the larvæ of the beautiful lady-bug in as great numbers, and with as much relish, as succulent oysters are gulped down by hungry aldermen — when the city pays the bill.

The dragon-flies, or darning-needles, are a predaceous race ; and, besides other small insects, they consume such clouds of those summer-evening pests, the mosquitos, as to have won for themselves the significant title of mosquito-hawks.

Certain flies, bearing some resemblance to the common wasp, and called ichneumon-flies, from their practice of destroying insects in the egg, just as their namesake, on the banks of the Nile, destroys the eggs of the crocodile, are most terrible enemies to the maggot of the weevil and the wheat-fly, and especially to the apple-tree caterpillar, in whose back they lay their eggs. "When these are hatched," says Dr. Leonard, who has carefully watched their operations, "the young ichneumons feed upon the fat of their living victims till fully grown, touching in the mean time no vital part, but finally causing their unlamented death."

But without proceeding further in this specification, and without enlarging upon the manifold virtues of the slandered mole and toad, it is pertinent to say, that by far the most efficient allies to the farmer, in his war against destructive insects, are the birds,—the beautiful singing-birds. It has been proved by actual count, that two sparrows, during a single hour, have carried to their nest forty caterpillars. The number of apple-moths, and millers prolific in hurtful larvæ, consumed in a season, by a swallow on the wing, is beyond the reach of computation. The grubs of various kinds, slaughtered by a common robin, in the months of May and June, while tending her young, would far outnumber all the Philistines slain by David in his whole life. Even the much-abused crow, about which the wise Solons of our State Legislatures waste their harmless ammunition every year, digests at least five hundred grubs to one kernel of corn. The lordly raven does not condescend to a vegetable diet when there is any fresh meat to be had. In a word, there is not one of the singing-birds of our fields, woods, and gardens, whether thrush or jay, cat-bird or black-bird, king-bird or blue-bird, wren or pee-wee, martin or bobolink,—not one in the whole range, from the humble ground-sparrow up to that "feathered lyric," the aspiring skylark, which does not deserve the profoundest gratitude and most pains-taking protection of the husbandman.

And yet, though rendering us valiant and voluntary service in our insect warfare, though gladdening our eyes in this dusty, sin-blighted world with forms and hues of beauty, though making our trees as divinely vocal as the oaks of Dodona, and flooding the air with their joyous music, like a vernal shower, they are stupidly, meanly, wickedly shot and robbed of their young by idle boys and empty-headed men.

We said, in the early part of this article, that the farmer should be a proficient in two grand departments of agricultural knowledge; that he should know how to impart to his fields a maximum fertility, and how to clothe his home with beauty. We have occupied so much space in the discussion of the first topic, that we have little left for the second, and, in this country, even more important one. We join, therefore, in Carlyle's prayer: "O for the power of condensation!"

How shall we render our homes more pleasant and attractive? Some one has said that the three most beautiful words in the English language are Mother, Home, and Heaven. They naturally go together, either of them implying the other two. The great error in Plato's Republic is his subversion of the family. No mere "community," whether foreshadowed by a Grecian philosopher or organized by a French Socialist, can develop in men the deepest sympathies and highest energies of their nature. Sunder the ties which unite them in family groups, and the incentive to labor is gone. The distinguished traveller, De Laborde, attributes the utter hopelessness of all attempts to elevate the character of the Bedouin Arabs, and to bring back to the land of Mohammed the social cultivation and national glory of its earlier history, to their indifference to their household gods. The sweet charities and beautiful amenities which spring up and flourish in the magic circle of home, cannot take root by the wayside of a nomadic life. They require "a local habitation." Family and property are correlative terms; the love of the one creates a desire for the other. The incentives which impel men to the drudgery of the shop or field lie in the fact that they "have given hostages to fortune"; that they can in reality, or in prospect, enjoy the fruits of their industry around some warm domestic hearth-stone. The poet appreciated, if he never experienced,

the reward of daily toil, as well as the motive to it, when he says : —

“Tis sweet to hear the watch-dog’s honest bark
Bay deep-mouthed welcome as we draw near home ;
’T is sweet to know there is an eye will mark
Our coming, and look brighter when we come.”

There are many homesteads which are not homes. Philosophically speaking, a true home has an attractive outward seeming and a luminous inward life. To secure the former, there must be some architectural fitness about the buildings, and an exhibition of good taste in the grounds. To secure the latter, there must be books, social and intellectual culture, and the hallowing influence of every Christian virtue. Human beings may exist in a habitation whose uncouth ugliness, concealed by no overshadowing tree or climbing vine, is a pain to the eye. They may accustom themselves to its shapeless deformity ; to the rude inconveniences, which fruitlessly exhaust their time and strength ; to the “ear-piercing fife” of half-starved squealing brutes, looking wistfully from hollow eyes, like animated “anatomies of melancholy,” or wallowing in impassable mud before the kitchen door ; to the stercoraceous stenches, which, exhaled from contiguous manure-heaps, do not “waste their sweetness on the desert air,” but pour through the broken windows, checked by no intervention of “shocking bad hats,” and neutralized by no fragrant breath of flowers. Such a place is not a home, but rather a lair for wild beasts ; and the children who come forth from it will carry its taint and its barbarism to the grave.

A fine-looking house, on the other hand, like a fine-looking woman, cannot but exert a cheerful and elevating influence upon the community. There is a renovating power in every object of beauty and of worth on which the eye of man can rest. Steele was not extravagant when he said of a certain lady, whom the poet Congreve had admired and celebrated, that “to have loved her was a liberal education.” We always grow into the likeness and catch the spirit of our surroundings. Our characters, like chameleons, take their hue from the objects with which they come in contact. But while we are thus material beings, in a material world which is sure to

affect us for good or evil, we must not forget that the subtle spiritual nature with which we are endowed was not meant to be simply a passive recipient of accidental influences. It is a positive entity, and aspires to feed on ambrosia and drink nectar with the gods. It is not all of life to live. There are other and higher functions of the human organism than the digestion of beef and bread. The gastric juice is not the universal solvent, vainly sought amid smoke and toil in the laboratories of the old alchemists. We have hearts as well as a digestive apparatus; heads as well as hands. If the stomach of the last Lord Orford did survive the rest of his person, it was a phenomenon not likely to be repeated. For ourselves and our children, the primal duty is intellectual and moral culture. Our sons should be thoroughly trained to some business or profession, so that they may be intelligent and useful members of the community, and not, in the grand epic of life, mere parentheses, which, in the language of the spelling-books, might be omitted without injuring the sense or construction of society. Our daughters should be taught that a genuine woman cannot be made wholly of cotton and crinoline; that the small head, which surmounts her vast circumference, should be radiant with thought,—the dome of a pure and broad-visioned soul; that her heart, striving, perhaps vainly, to beat beneath her encircling zone, was intended for something more than to flutter with hope under the smiling glance of a city exquisite, or to tremble with fear at sight of a spider or a *cow*; that it is her divine right, not only

“to sing, to dance,
To dress and troll the tongue and roll the eye,”

but to develop every faculty of the mental and moral nature, to such an extent and completeness that she may always be a sunshine in the shady places of life, the light and joy of home; that it is her sphere “to study household good,” to keep the vestal fires undimmed, to elevate the tone of social intercourse, and purify the currents of life at their fountain; that it is her mission, not to be fondled like a passive, painted doll, but to think and act like a living intelligence, conscious of its power and its responsibility.

When each member of the family is thus educated, our homes will glow with a new lustre, because we shall see in them, not merely the embellishments of a cultivated taste, but also the reflection of a beauty first radiated from our own spirits. "We need not then visit the Como Lake or the Madeira Islands." The alluring cry of the gold-hunter and the rifle-crack of the adventurous pioneer will have no power in that "good time coming"; but, laboring with quickened energies and a higher intelligence, we shall illustrate, on the wasted acres where our fathers toiled, the prophecy of the inspired seer, "There shall be a handful of corn in the tops of the mountains, and the fruit thereof shall shake like Lebanon," and, at the same time, we shall make the spot, which our "young barbarians all at play" call their home, attractive for its artistic beauty, and, in its moral influence, the nursery of every manly excellence and womanly virtue.

ART. V.—*The Age of Chivalry*. Part I. *King Arthur and his Knights*. Part II. *The Mabinogion; or, Welsh Popular Tales*. By THOMAS BULFINCH, Author of "The Age of Fable." Boston: Crosby, Nichols, & Co. 1859. 12mo. pp. 414.

AMONG the complimentary epithets with which our periodical press and public speakers are wont to greet the American people at large, and certain sections of it more particularly, there are few of more constant recurrence than the term *chivalrous*. We have heard much, for years, of American chivalry, and of Southern chivalry. In the one case, the word is supposed to denote the character of the relations existing between the sexes in this country; in the other, to refer to certain qualities which it is claimed distinguish advantageously those of our citizens residing in the South from their Northern brethren. It is not our present purpose to inquire how far the assumption is warranted in either case, except inasmuch as its correctness depends upon the meaning of the term employed.